

EXHIBIT 1

FORM PTO-1449
Inventor "Lars Friedrich"
Filing date 08/31/2000.

Form PTO-1449 (Modified)



**FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE
(Modified) PATENT AND TRADEMARK OFFICE**

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use several sheets if necessary)

(37 CFR 1.98(b))

~~E~~ATTY. DOCKET NO.
S
326

SERIAL NO.
09/651,140

APPLICANT: Lars Friedrich

FILING DATE: 08/31/00

GROUP: ~~theastiniat~~

RECEIVED 2033
FEB 2 1968

21 2001
Technology

U.S. PATENT DOCUMENTS

FOREIGN PATENT OR PUBLISHED FOREIGN PATENT APPLICATION

OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication***)**

A. M. Hill, et al., "Nonlinear Crosstalk Due to Stimulated Raman Scattering in a Two-Channel Wavelength-Division-Multiplexed System", Electronics Letters, Vol. 20, No. 6, 1984

EXAMINER

DATE CONSIDERED

9/16/03

EXAMINER: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

EXHIBIT 2

U.S. Patent No. 6,466,362 B1
Serial No. 09/651,840
Inventor "Lars Friedrich"
Filing date 08/31/2000



US006466362B1

(12) United States Patent
Friedrich(10) Patent No.: US 6,466,362 B1
(45) Date of Patent: Oct. 15, 2002

(54) HYBRID AMPLIFIER AND CONTROL
METHOD HEREOF THAT MINIMIZES A
NOISE FIGURE FOR PARTICULAR SPAN
LOSS

(75) Inventor: Lars Friedrich, Glen Burnie, MD (US)

(73) Assignee: Clea Corporation, Linthicum, MD
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/651,840

(22) Filed: Aug. 31, 2000

(51) Int. Cl. 7 H01S 3/30

(52) U.S. Cl. 359/334; 359/341.1; 359/337

(58) Field of Search 359/341.41, 341.42,
359/334, 337, 337.4

(56) References Cited

U.S. PATENT DOCUMENTS

5,900,969 A * 5/1999 Srivastava et al. 359/161
6,049,413 A * 4/2000 Taylor et al. 359/337
6,064,501 A * 5/2000 Roberts et al. 359/110
6,091,539 A * 7/2000 Kosaka 359/124
6,185,025 B1 * 2/2001 Blows et al. 359/188
6,236,487 B1 * 5/2001 Stephens 359/124
6,313,940 B1 * 11/2001 Bode et al. 359/117
6,323,993 B1 * 11/2001 Hansen et al. 359/337

OTHER PUBLICATIONS

Masuda et al. ECOC '98, Sep. 20-24, 1998.*

Masuda et al. Electronic Letts. Mar. 4, 1999 vol. 35 No. 5.*

Masuda et al. Electronic Letts. Jun. 25, 1998 vol. 34 No.

13.*

Masuda, OFCC. Mar. 7-10, 2000.*

Masuda, H.; Suzuki K.I.; and Aida, K. "Ultra-wideband optical amplification with 3 dB bandwidth of 65nm using a gain-equalised two-stage erbium-doped fibre amplifier and Raman amplification." Apr. 24, 1997. Electronic Letters. vol. 3 No. 9 pp. 753-754.*

* cited by examiner

Primary Examiner—Thomas H. Tarcza

Assistant Examiner—Stephen Cunningham

(74) Attorney, Agent, or Firm—Michael R. Cammarata

(57) ABSTRACT

A hybrid amplifier reduces the noise generated by the hybrid amplifier. The hybrid amplifier includes a rare-earth doped fiber amplifier such as an EDFA (erbium-doped fiber amp), a Raman amplifier, a controller and a memory device. Noise is reduced by determining a gain balance between the EDFA and Raman amp that minimizes the noise figure. The controller performs a method that generates a plurality of functions relating the hybrid amp noise figure and the Raman gain for a particular span loss. These functions are then utilized to determine the Raman gain portion of the gain balance that minimizes the noise figure. The remaining portion of the gain balance is made up by the EDFA. For a hybrid amplifier that will see only one span loss value, then only one such function needs to be generated. Furthermore, the memory device of the hybrid amplifier can be programmed to store an optimum control curve that minimizes the noise figure for one or a plurality of span losses.

13 Claims, 8 Drawing Sheets

